

AC NO: 120-29

DATE: 9/25/70



ADVISORY CIRCULAR

**CRITERIA FOR APPROVING CATEGORY I AND CATEGORY II
LANDING MINIMA FOR FAR 121 OPERATORS**

REPRINTED OCTOBER 1979

THIS REPRINT INCLUDES CHANGES 1 THROUGH 3

**DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION**

AC NO: 120-29

DATE: 9/25/70



ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION

SUBJECT: CRITERIA FOR APPROVING CATEGORY I AND CATEGORY II LANDING
MINIMA FOR FAR 121 OPERATORS

1. PURPOSE. This advisory circular combines into one circular material contained in Advisory Circulars 120-4B and 120-20. It sets forth criteria used by FAA in approving turbojet landing minima of less than 300-3/4 or RVR 4000 (Category I) and Category II minima for all aircraft.
2. CANCELLATION. Advisory Circulars 120-4B and 120-20 are hereby canceled.
3. APPLICABILITY. These criteria are applicable to operators holding operating certificates issued pursuant to Parts 121, 123 and 135 (large aircraft only). FAA grants approvals of these minima by amending the applicant's operations specifications.


Acting Director
Flight Standards Service

Initiated by: FS-410

TABLE OF CONTENTS

	<u>Page No.</u>
CHAPTER 1. COMBINED CRITERIA CATEGORIES I AND II	
1. Definitions.	1
2. Airport Facilities.	1
3. U. S. Military and Foreign Airports.	1
4. Airborne Equipment.	3
5. Pilot Training and Proficiency Program.	3
6. Operational Requirements - Categories I and II.	5
7. Foreign Air Carriers.	7
CHAPTER 2. ADDITIONAL CATEGORY II CRITERIA	
8. General.	9
9. Operational Procedures.	9
10. Airborne System Evaluation.	10
11. Operational Demonstration of the Low Approach System.	11
12. System Fault Detection.	12
13. Maintenance Program.	12
14. Approval of Category II Weather Minima.	13
APPENDIX 1. AIRWORTHINESS APPROVAL FOR CATEGORY II INSTALLATION OF AIRBORNE NAVIGATION, INSTRUMENT, AND FLIGHT CONTROL SYSTEMS IN TRANSPORT CATEGORY AIRCRAFT	
1. Purpose.	1
2. General Criteria.	1
3. Equipment Approval Criteria.	1
4. Inspection and Test Program.	1
5. Reserved.	2
6. Approved Airplane Flight Manual or Markings or Placards.	2
7. Systems Performance Requirements.	2
8. Combined Systems Criteria.	2
9. Individual System Criteria.	3
APPENDIX 2. GROUND SYSTEM AND OBSTRUCTION CLEARANCE CRITERIA FOR CATEGORY II OPERATIONS	
1. Purpose.	1
2. General.	1
3. Section I - Category II Ground System.	1
4. Obstacle Clearance Criteria.	4
5. Special Obstruction Clearance Areas	7
6. Approach Light Area	7
7. Touchdown Area	8
8. Touchdown Area Transitional Surfaces	9
9. Missed Approach Area.	9

9/25/70

10. Glide Slope Angle.	12
11. Glide Slope Threshold Crossing Height.	12
12. Adjustment to Category II ILS Minimums.	12
13. Obstructions in the Missed Approach Area.	14

CHAPTER 1. COMBINED CRITERIA CATEGORIES I AND II

1. DEFINITIONS.

- a. Category I. An instrument approach procedure which provides for approaches to a decision height (DH) of not less than 200 feet and visibility of not less than 1/2 mile or RVR 2400 (RVR 1800 with operative touchdown zone and runway centerline lights).
- b. Category II. An instrument approach procedure which provides approaches to minima of less than DH 200 feet/RVR 2400 to as low as DH 100 feet/RVR 1200.
- c. MALS/R. Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights. (See Figure 27, AC 150/5300-2A)
- d. SSALS/R. Simplified Short Approach Lighting System with Runway Alignment Indicator Lights. (See Figure 25, AC 150/5300-2A)

2. AIRPORT FACILITIES. The Category I and Category II weather minima shown in Figure 1-1 below may be authorized at U. S. civil airports based on the ground aids specified therein. Additional details concerning Category II requirements are contained in Appendix 2.

3. U. S. MILITARY AND FOREIGN AIRPORTS.

- a. Category I. The Category I landing minima specified in Figure 1-1 below may also be authorized at U. S. military and foreign airports when the applicant shows that the ground facilities are equivalent to the facilities specified in Figure 1-1. ICAO Annex 14 recommends rather than requiring sequenced flashing lights as an adjunct to the ICAO standard precision approach light system. Therefore, the minima specified in Figure 1-1 requiring ALSF-1 may be authorized at U. S. military and foreign airports without sequenced flashing lights, if the approach light system provides adequate guidance. The following systems are considered to be equivalent to the U. S. standard configuration "A" ALS (ALSF-1):

- (1) U. S. configuration "B."
- (2) NATO standard (C).
- (3) Navy composite (U. S.).
- (4) Calvert (British).
- (5) Centerline (high intensity).
- (6) Centre Row DOT standard.

WEATHER MINIMA AND REQUIRED GROUND FACILITIES

Aircraft Category	ALSF-1 and HIRL	SSALS/R or MALS/R & MIRL	TDZ	CL	All WX Runway Marking	Number of Transmissometers	Weather Minima
Category D Jets	X				X or CL	One - When RVR operative	200-1/2/RVR 2400
Category A, B, and C Jets		X			X or CL	Not applicable	200-1/2
Category D Jets	X		X	X		One - Required	RVR 2000
Category A, B and C Jets	X		X	X		One - Required	RVR 1800
All Aircraft	X		X	X	X	One - Required for RVR less than 1800 and DH less than 200 feet. Two - Required for RVR less than 1600.	RVR 1600 and 1200

Figure 1-1

- b. Category II. Category II minima may be authorized at foreign airports when the electronic and visual ground aids are equivalent to those specified in Appendix 2. FAA will evaluate each such airport and will give major consideration to the approach light system, high intensity runway lights, in-runway lights, runway marking, and visibility reporting procedures. Although the systems at foreign airports may not exactly conform to U. S. standards, it is important that pilots receive adequate visual cues and accurate weather reports. Satisfactory procedures for controlling ground vehicles and aircraft while taxiing to prevent interference with transmitted electronic guidance signals should be included as a major consideration for approving Category II at U. S. military and foreign airports.
- 4. AIRBORNE EQUIPMENT. Approval of Category I or Category II minima is based on installation of the equipment specified in Figure 1-2. Use of improved barometric altimeters has not been shown in Figure 1-2 as a means of identifying the Category II decision height, since at this writing only one air carrier has such approval and no other carriers have expressed an interest. However, this should not be construed as rescinding the existing authorization nor does it preclude consideration of individual requests and subsequent approvals if such applicants demonstrate the accuracy of their barometric altimeters by means of a test program acceptable to FAA.
- 5. PILOT TRAINING AND PROFICIENCY PROGRAM.
 - a. Category II Ground Training (All Aircraft). The applicant's approved training program must be amended to provide training for pilots in command and seconds in command in the following subjects:
 - (1) The operational characteristics, capabilities and limitations of the Category II ILS and visual aids (e.g., approach lights, in-runway lights, transmissometers, etc.).
 - (2) The operational characteristics, capabilities and limitations of the Category II airborne system to be used by the applicant, including the following, as appropriate:
 - (a) The flight director system.
 - (b) The automatic approach coupler (including split axis).
 - (c) The system used to identify the decision height.
 - (d) The instrumentation and display systems.
 - (e) Automatic throttle systems.
 - (f) Other systems and devices peculiar to the applicant's installation; i.e., computed go-around guidance, failure warning systems, etc.

AIRBORNE EQUIPMENT REQUIREMENTS
CATEGORIES I AND II

Minimum Requirements	CAT I (Turbojet Only)	CAT II (All Aircraft)
Single Flight Director <u>1/</u> or Single Automatic Approach Coupler <u>2/</u>	Required	Minimum requirement - Two- engine propeller aircraft only.
Instrument Failure Warning System	Optional <u>3/</u>	Required plus flight crew assignments and procedures specified in Note <u>3/</u> below.
Dual ILS and Glide Slope Receivers	Not required (N.R.)	Required
Single Flight Director with Dual Displays <u>1/</u> and Single Automatic Approach Coupler <u>2/</u> or Two Independent Flight Director Systems	N.R.	Required
Equipment for Identification of Decision Height	N.R.	Required. Can be: (1) Radar altimeter, or (2) Inner Markers.
Missed Approach Attitude Guidance	N.R.	Required. Can be: (1) Attitude gyros with calibrated pitch markings, or (2) Flight director pitch command, or (3) Computed pitch command.
Auto Throttle System	N.R.	Required all turbojets if oper- ations based on dual flight directors. Also required any aircraft using split axis couplers if applicant can't show it does not significantly reduce pilot workload.
Rain Removal Equipment	N.R.	Required

1/ Single axis flight directors if basic glide slope information
displayed on same instrument.

2/ Split axis acceptable.

3/ If improved failure warning system not provided for CAT I operations
applicant must establish flight crew procedures and duty assignments
to provide immediate detection of essential instrument and equipment
failures. Such procedures and assignments are required for
Category II operations.

Figure 1-2

- (3) The following additional subjects will be covered during initial and recurrent proficiency checks of pilots in command and seconds in command:
 - (a) Resolution of the decision height.
 - (b) Missed approach technique using fixed or computed attitude guidance display, as appropriate.
 - (c) Runway Visual Range; its use and limitations.
 - (d) The use of visual cues associated with the runway environment during Category II weather conditions with different glide slope angles, cockpit cutoff angles, and the altitude at which these visual cues are normally discernible.
 - (e) Transition from nonvisual to visual flight during RVR 1600, 1200 and subsequent lower values such as 1000 and 800 using an approved aircraft simulator with a visual system or other training aids, such as films.
 - (f) The effect of vertical and horizontal wind shear.
 - (g) Review of the Category II operations specifications.
- b. Flight Training - Categories I and II. The initial and recurrent training requirements for pilots in command and seconds in command are shown in Figure 1-3. The maneuvers are categorized according to the low approach system installed in the applicant's aircraft.
- 6. OPERATIONAL REQUIREMENTS - CATEGORIES I AND II. The applicant's minimum equipment list and operations manual must be amended to include the following, as appropriate:
 - a. Operations Based on Dual Flight Directors or Single Flight Director and Approach Coupler.
 - (1) Category I Operations.
 - (a) Both systems must be operative at the time of flight release if a combination of weather reports and forecasts indicates the weather at the destination airport will be below 3/4-mile visibility or RVR 4000 at the estimated time of arrival, and the pilot in command has not demonstrated a raw data ILS approach.

PILOT FLIGHT TRAINING REQUIREMENTS

Low Approach System	Maneuvers <u>1/</u>	CAT I Turbojets Only	<u>2/</u> CAT II All Aircraft
		PIC Initial/Recurrent <u>3/</u>	Initial/Recurrent <u>3/</u>
1. Dual Flight Director	(a) Two ILS approaches to 100 feet; from one a landing will be accomplished and from the other a missed approach.	Satisfactorily demonstrate (a) to a company check pilot or an FAA inspector.	Satisfactorily demonstrate (a) to a company check pilot or an FAA inspector.
2. Flight Director <u>and</u> Approach Coupler (Dual Flight Director CAT II)	(b) Two ILS approaches to 100 feet; one using flight director and one using auto coupler; from one a landing will be accomplished and from the other a missed approach.	Satisfactorily demonstrate (b) to a company check pilot or an FAA inspector. <u>4/</u>	Satisfactorily demonstrate (b) to a company check pilot or an FAA inspector. <u>4/</u>
3. Single Flight Director <u>or</u> Approach Coupler	(c) One raw data ILS approach to 200 feet. (d) One ILS approach to 100 feet using flight director or approach coupler. (e) From one of the approaches specified in (c) and (d), a landing will be accomplished; from the other, a missed approach.	Satisfactorily demonstrate (c), (d) and (e) to a company check pilot or an FAA inspector.	Satisfactorily demonstrate (c), (d) and (e) to a company check pilot or an FAA inspector. Applicable to two-engine propeller aircraft only.

*1/ Either an aircraft or an approved visual simulator may be used. When accomplished in an aircraft, a hood will be used to simulate the weather. When accomplished in an approved visual simulator, the system must simulate the appropriate category of weather, ceiling and visibility, and be equipped with an appropriate lighting system which depicts the approach and runway lights. *

2/ Seconds in command not expressly prohibited by the operator from conducting Category II approaches will meet the same initial and recurrent flight training requirements specified for pilots in command. In any case, each second in command will demonstrate to a company check pilot or FAA inspector his ability to perform his assigned function during initial and recurrent training.

*3/ If pilot qualified in more than one type aircraft, check may be accomplished in one such type if approach guidance systems installed in each type are comparable. Otherwise, check will be accomplished at least annually in each type. *

4/ Coupler demonstration need not be accomplished during recurrent training if pilot qualified to use flight director and approach coupler. However, two ILS approaches must be conducted to accomplish the landing and missed approach requirements.

Figure 1-3

- (b) When the pilot in command has demonstrated a raw data ILS approach, one system must be operative at the time of flight release, if a combination of weather reports and forecasts indicates the weather at the destination airport will be below 3/4-mile visibility or RVR 4000 at the estimated time of arrival.

- (2) Category II Operations. Both systems must be operative at the time of flight release if a combination of weather reports and forecasts indicates that Category II weather conditions will exist at the destination airport at the estimated time of arrival.

b. Single Flight Director or Approach Coupler.

- (1) Category I Operations. The applicable system must be operative at the time of flight release if a combination of weather reports and forecasts indicates the weather at the destination airport will be below 3/4-mile visibility or RVR 4000 at the estimated time of arrival.
- (2) Category II Operations - Two-Engine Propeller Aircraft ONLY. The applicable system must be operative at the time of flight release if a combination of weather reports and forecasts indicates that Category II weather conditions will exist at the destination airport at the estimated time of arrival.

NOTE: Pilots MUST have demonstrated a raw data ILS approach.

- 7. FOREIGN AIR CARRIERS. The operations specifications of foreign flag air carriers may be amended to authorize the weather minima specified in Figure 1-1, provided such air carriers are authorized these minima by the State of Registry.

7/27/72

CHAPTER 2. ADDITIONAL CATEGORY II CRITERIA

8. GENERAL. The material contained in this chapter and Appendices 1, 2 and 3 is applicable to the approval of Category II weather minima.
9. OPERATIONAL PROCEDURES. Procedures and instructions to be used and adhered to by its flight crews are to be developed by each air carrier to include, as applicable, at least the following:
 - a. Approach monitoring. Crewmember duties during a Category II approach are to be clearly delineated in the operations manual.
 - b. Testing of the radar (radio) altimeter by either a functional test or an acceptable operational procedure.
 - c. Use of RVR information.
 - d. Decision region. The region between the middle marker and the 100' point where the pilot must decide to either continue his approach or execute a go-around. Instructions to pilots should include the maximum permissible excursions of the raw ILS deviation from which a landing can be made.
 - e. Missed approach procedure.
 - f. Use of airborne low approach equipment including cross-over system, if provided.
 - g. Instrument failure warning system.
10. AIRBORNE SYSTEM EVALUATION. Performance of the flight control guidance system may be demonstrated by showing compliance with either:
 - a. The criteria contained in Appendix 1, or
 - b. The provisions of paragraph 11 below.
- * NOTE: Compliance with Appendix 1 or paragraph 11 constitutes equipment and installation approval only. The applicant must still comply with the maintenance program requirements of paragraph 13 before Category II operational approval can be obtained. *
11. OPERATIONAL DEMONSTRATION OF THE LOW APPROACH SYSTEM. The following provisions apply to an applicant selecting this method of demonstrating its airborne system:
 - a. Conduct at least 300 approaches to 100' in each aircraft type, except that if additional aircraft types are configured with the same basic low approach system, the additional approaches may be reduced by one-half. These approaches may be accomplished in line operations or during training and demonstration flights or any

combination thereof. Eighty-five (85%) percent of the total demonstrations conducted during line operations must be successful and 90 percent conducted during training or demonstration flights must be successful. (See paragraph 11.c. for a definition of a successful approach.) Approaches are to be accomplished in accordance with the following:

- (1) A minimum of three ILS facilities are to be used during the demonstrations and at least 10 percent of the total approaches are to be conducted on each of at least three of the facilities selected. The number of approaches conducted on additional facilities can be at the applicant's discretion.
- (2) The low approaches should be accomplished on Category II ILS facilities. However, at the applicant's option, demonstration may be made on Category I ILS facilities.
- (3) No more than 15 approaches per day are to be conducted on a single facility.
- (4) No more than 60 percent of the approaches are to be conducted in any single aircraft.
- (5) Where an applicant has different models of aircraft within a given type which utilize the same basic flight-control guidance system, the applicant is to assure that the various models comply with the basic system performance criteria.
- (6) A representative number of pilots assigned to an aircraft type are to be used in the conduct of these approaches. No single pilot in command shall perform more than 15 percent of these approaches except when the total number of crews located at a small domicile requires a greater percentage.
- (7) At least 30 percent of the approaches will be observed by FAA Air Carrier Operations Inspectors.

b. Data Collection During Airborne System Evaluation. Each applicant is to develop a form to be used by the flight crews to record data listed below. This form will be completed whenever an approach is attempted utilizing the airborne low approach system regardless of whether it is initiated, abandoned or concluded successfully. The completed forms will be made available to the assigned FAA Principal Operations Inspector for his evaluation.

- (1) If unable to initiate approach due to a deficiency in the airborne equipment, state deficiency.
- (2) If approach is abandoned, give reasons and altitude above runway at which approach was discontinued.

- (3) Adequacy of speed control at the 100' point (if auto throttle used).
- (4) Was airplane in trim at the 100' point for continuation to flare and landing?
- (5) Compatibility of flight director with auto coupler.
- (6) Diagram of cockpit raw ILS display and diagram of runway extended to middle marker. Flight crew to indicate position of airplane at middle marker, 100' point and estimated touch-down point.
- (7) Quality of overall system performance.

NOTE: Unsuccessful approaches attributed to ATC instructions may be excluded from the statistical data; for example, flights vectored too close in for adequate localizer and glide slope capture and ATC requests to abandon approach. Also, unsuccessful approaches may be excluded from consideration when they are due to faulty ground station signals and where a pattern of such faulty performance can be established.

c. Definition of a Successful Approach. For the purpose of the airborne system evaluation, a successful approach is one in which, at the 100' point:

- (1) The airplane is in trim so as to allow for continuation of normal approach and landing.
- (2) The indicated airspeed and heading are satisfactory for a normal flare and landing. If an auto throttle control system is used, speed must be ± 5 knots of programmed airspeed but may not be less than computed threshold speed.
- (3) The airplane is positioned so that the cockpit is within, and tracking so as to remain within, the lateral confines of the runway extended.
- (4) Deviation from glide slope does not exceed ± 75 microamps as displayed on the ILS indicator.
- (5) No unusual roughness or excessive attitude changes occur after leaving middle marker.

7/26/72

12. SYSTEM FAULT DETECTION. The applicant is to submit a description of the proposed Category II system which outlines the methods of detecting and protecting against the consequences of single failures. Warning flags that are used must be easily discernible under all lighting conditions. The following, as appropriate, will be treated in the description:
- a. Attitude (vertical gyro).
 - b. Heading.
 - c. Auto throttle system.
 - d. Altitude.
 - e. ILS instrument.
 - f. Flight director system.
 - g. Any other equipment essential to the system.
13. MAINTENANCE PROGRAM. Each applicant is to establish a maintenance program, acceptable to the FAA, to assure that the airborne electronic equipment will continue at the level of performance and reliability demonstrated during the evaluation program. The following are the minimum requirements:
- a. Reliability Reporting. For a period of one year after an applicant has been advised that its low approach system meets Category II requirements, and reduced minima are authorized, the operator is to provide a monthly summary to the FAA of the following information:
 - (1) The total number of approaches where the equipment constituting the airborne portion of the Category II system was utilized to make satisfactory actual or simulated approaches to Category II minima (by aircraft type).
 - (2) The total number of unsatisfactory approaches and the reasons therefore (broken down into appropriate categories - airborne equipment faults, ground facility difficulties, aborts of approaches because of ATC instructions) by airport and aircraft registration number.
 - * (3) The total number of removals of avionic components within the systems upon which the applicant's Category II approval was based.
 - b. Each applicant is to establish an initial and recurrent training program, acceptable to the FAA, for personnel performing maintenance work on Category II airborne systems and equipment. Training records for such personnel are to be kept current and made available to the FAA for inspection. *

- * c. Test Equipment and Standards. The operator's program for maintenance of line (ramp) test equipment, shop (bench) test equipment, and a listing of all primary and secondary standards utilized during maintenance of test equipment which relate to Category II operations are to be submitted to the FAA for determination of adequacy. Emphasis will be placed on standards associated with ILS receivers, flight directors, autopilot/couplers and altimeter systems. *
- d. Maintenance Procedures. Any changes to maintenance procedures, practices or limitations which were established in qualification for Category II operations are to be submitted to the FAA for acceptance before any such changes are adopted.
- e. Engineering Modifications. Titles and numbers of all modifications, additions and changes which were made to qualify aircraft systems for Category II performance are to be provided to FAA.

14. APPROVAL OF CATEGORY II WEATHER MINIMA.

- a. U.S. Operators. When an applicant has complied with the appropriate provisions of these criteria, operations specifications authorizing 1600 RVR with a 150-foot decision height will be issued. During the six-month period following the issuance of these specifications, the air carrier, when practicable, should use the Category II airborne system regardless of weather minimums, to ensure continued performance and reliability of the system. If there is a significant deterioration in the performance and reliability of the airborne equipment, approval of 1200 RVR will be withheld and authorization for 1600 RVR may be suspended unless positive corrective action is taken. When the operator exercises its airborne systems at airports where the ILS is not of Category II quality, or when other conditions not normal for Category II approaches are encountered, the performance standards specified for normal Category II conditions need not be met. When the first six months of operations have been analyzed and found acceptable, the operator will be authorized to operate at 1200 RVR with a decision height of 100 feet.
- b. Foreign Air Carriers. Foreign flag air carrier operations specifications may be amended to authorize Category II landing minimums in accordance with paragraph (a) above, provided the air carrier:
 - (1) Is authorized for these minima by the State of Registry, and
 - (2) Certifies that its Category II program is equivalent to that required for U.S. air carriers by this advisory circular.

APPENDIX 1. AIRWORTHINESS APPROVAL FOR CATEGORY II INSTALLATION OF AIRBORNE NAVIGATION, INSTRUMENT, AND FLIGHT CONTROL SYSTEMS IN TRANSPORT CATEGORY AIRCRAFT.

1. PURPOSE. This appendix contains criteria for the approval of airborne equipment and their installations when the applicant desires to have a statement in approved flight manuals that his equipment meets Category II performance.
2. GENERAL CRITERIA. The type certification approval for the equipment, system installations and test methods should be based on a consideration of factors such as the intended function of the installed system, its accuracy, reliability and failsafe features. In addition, approval should be based on demonstrated compatibility with Category II ground facilities. The guidelines and procedures contained herein are considered acceptable methods of determining transport category airplane airworthiness for use in Category II IFR operations. Type certification based on other criteria may also be considered acceptable when found to be equivalent and approved by the FAA.
3. EQUIPMENT APPROVAL CRITERIA. Airborne navigation instrument and/or flight control equipment may be eligible for installation approval as part of an installed system when it is:
 - a. Found to comply with the requirements of an applicable technical standard order or type certificate, or
 - b. Found to comply with applicable Federal Aviation Regulations and approved as part of an airplane under a type certificate or supplemental type certificate, or
 - c. Found to comply with other pertinent specifications adopted by the Administrator; e.g., military standards or a foreign government's validation which has been found to be compatible with the intent of the appropriate Federal Aviation Regulations.
4. INSPECTION AND TEST PROGRAM. Agreement should be reached with the applicant on his proposed flight test program, which should be conducted to determine compliance with the requirements of this document of the pertinent systems installed. Upon completion of Federal Aviation Administration engineering design and ground testing program evaluations on the combination of systems proposed as a basis for a Category II installation indicating that the system will meet the prescribed criteria, a Type Inspection Authorization, or similar document should be issued. This document will specify the necessary conformity inspections and tests to be conducted, both on the ground and in flight. It should include determination of satisfactory installation practices, freedom from interferences, compatibility with ground navigation facilities and the Air Traffic Control System, and

performance of intended functions. Performance testing in flight should cover representative and critical phases of operation including equipment malfunction simulation.

5. RESERVED.

6. APPROVED AIRPLANE FLIGHT MANUAL OR MARKINGS OR PLACARDS. Upon satisfactory completion of an engineering inspection and test program, the FAA airplane flight manual or supplement thereto, or markings or placards should reflect the following:

- a. The limitations, if any.
- b. Revision to the performance section, if appropriate.
- c. A statement of CAT II approval to the effect that, "The airborne instruments and equipment meet the performance standards of Appendix 1 of this advisory circular.

NOTE: Compliance with the performance standards referenced above, does not constitute approval to conduct Category II operations.

7. SYSTEMS PERFORMANCE REQUIREMENTS. For the combination of systems to provide the level of accuracy, reliability, and compatibility needed to assure an approach capability which is considered acceptable to the Administrator, each individual system should be found to perform its intended function in accordance with the following:

- a. Control Functions. All systems which furnish signals directly to the airplane flight control system or the propulsion thrust control system should be so designed that if malfunction occurs, such malfunction does not result in an unsafe configuration. Means for quick disengaging or overriding of each automatic control function should be immediately available to the flight crew without requiring the application of excessive forces and the assuming of any unusual position.
- b. Malfunction of Monitoring Functions. A reasonable probable malfunction in any monitoring subsystem should be incapable of causing a malfunction of any ESSENTIAL system unless such essential system malfunction is indicated to the flight crew.

8. COMBINED SYSTEMS CRITERIA.

- a. Eligibility for Category II operations includes compliance with applicable sections of Federal Aviation Regulations, Part 25.
- b. A combination of airborne navigation, instrument, and flight control systems, having individual system installation approvals, may be eligible for Category II installations approval when:

- (1) Found to provide information to the flight crew with sufficient accuracy and reliability to permit the manual control of the airplane along the flight path within prescribed limits.
 - (2) Or found to provide signals to the airplane flight control systems with sufficient accuracy, and reliability to maintain the aircraft along the approach flight path within prescribed limits.
 - (3) Or found to provide a combination of automatic flight, propulsion control, and other information to the flight crew to permit manual control of the aircraft, supplemented by automatic control, along the approach flight path within prescribed limits.
9. INDIVIDUAL SYSTEM CRITERIA. Individual Category II airborne systems should comply with the pertinent sections of this appendix and the following performance criteria:
- a. Localizer. The localizer system installation should comply with the following:
 - (1) The localizer equipment should meet or exceed the minimum performance standards set forth in Federal Aviation Administration Technical Standard Orders C36, C36a, C36b, or RTCA Paper DO-131 dated 15 December 1965, "Minimum Performance Standards - ILS Localizer Receiving Equipment."
 - (2) The localizer system installation should meet or exceed the minimum performance standards set forth in RTCA Paper 69-60/DO-102, dated 12 April 1960, "Minimum In-Flight Performance Standards - ILS Localizer Receiving Equipment."
 - (3) Display to the pilot positive visual indication to show degradation of localizer system performance under the following conditions:
 - (a) The absence of either or both modulation signals.
 - (b) The reduction of both modulation signals to one-half the normal 20 percent.
 - (c) When a difference of depth of modulation equal to 0.093 ± 0.002 produces an output of less than one-half normal response to this standard localizer deviation signal.
 - (4) The localizer receiving centering error should be within 5 ua on a 95 percent probability basis under the following conditions, using a standard test signal:

- (a) Variation of R.F. signal level from 50 to 1,000 uv.
NOTE: This represents the variation of R.F. signal level expected during the final phase of an ILS approach.
 - (b) Variation of DC power over the range of 24 to 28 volts or AC power over the range of 105 to 120 volts.
 - (c) Variation of ambient temperature over the limited range expected during a normal ILS approach. The nominal ambient temperature range is defined as +10°C. to +40°C. Operation over a different temperature range in a particular airplane will require special coordination.
- (5) The localizer receiving equipment should be adjusted in accordance with RTCA Paper 23-63/DO-117, dated 14 March 1963, "Standard Adjustment Criteria for Airborne Localizer and Glide Slope Receivers."
- b. Glide Slope. The glide slope system installation should comply with the following:
- (1) The glide slope equipment should meet or exceed the minimum performance standards set forth in Federal Aviation Administration Technical Standard Orders C34, C34a, C34b, or RTCA Paper DO-132 dated 15 March 1966, "Minimum Performance Standards - ILS Glide Slope Receiving Equipment."
 - (2) The glide slope system installation should meet or exceed the minimum performance standards set forth in RTCA Paper 233-59/DO-101, dated 9 December 1959, "Minimum In-Flight Performance Standards - ILS Glide Slope Receiving Equipment."
 - (3) Display to the pilot positive visual indication to show degradation of glide slope system performance under the following conditions:
 - (a) The absence of either or both modulation signals.
 - (b) The reduction of both modulation signals to one-half of their normal 40 percent.
 - (c) When a difference of depth of modulation equal to $0.091 \pm .002$ produces an output of less than one-half normal response to this standard glide slope deviation signal.
 - (4) Centering Error: - The glide slope centering requirements outlined in RTCA Paper 222-58/DO-89 are applicable for Category II installation approval.

- (5) The glide slope receiving equipment should be adjusted in accordance with RTCA Paper 23-63/DO-117, dated 14 March 1963, "Standard Adjustment Criteria for Airborne Localizer and Glide Slope Receivers."
- * (6) When deviating from the present 19 foot criteria in antenna location when the aircraft is flown either manually or utilizing an approved automatic landing system the following conditions must be met:
 - (a) The vertical distance between the glide slope antenna and the main landing gear wheels shall not be greater than that which will result in a nominal height of wheels over threshold of 20 feet when the aircraft is flown at a recommended operationally acceptable landing weight along a glide path meeting the 50 foot + 10/- 3 threshold crossing height.
 - (b) When all tolerances are considered in reasonable probable combinations, the aircraft shall not be placed in a position where the wheels cross less than 10 feet over the threshold. This analysis must consider meteorological effects and include reasonable values of windshear.
 - (c) The analysis must show that adequate safety margin is provided when the airplane is flown manually through the approach and landing and, if appropriate, along a path similar to that used by the automatic system and for manual landings resulting from takeover at any point during an automatic landing. *
- c. Automatic Pilot/Coupler. When an automatic pilot/coupler system is used as part of a Category II installation, it should, in addition to complying with applicable TSO and FAR/advisory circular material, provide the following performance under the test condition stated:
 - (1) Airplane Speed - Maximum and minimum design approach speeds.
 - (2) Wind Conditions (the effects may be shown analytically) - Surface downwind component of 10 knots. Windshear of 4 knots per 100 feet altitude applied along the runway or across the runway individually, commencing at an altitude of 500 feet.

(3) Localizer Performance -

- (a) The airplane should be stabilized on the localizer for the purpose of demonstration before the outer marker is intercepted on a normal inbound approach.
- (b) From the outer marker to an altitude of 300 feet above runway elevation on the approach path, the automatic pilot/coupler should cause the airplane to track automatically to within ± 35 microamperes (95 percent probability) of the indicated localizer course. The performance should be free of sustained oscillations.
- (c) From an altitude 300 feet above runway elevation on the approach path to the decision altitude (100 feet), the automatic pilot/coupler should cause the airplane to track automatically to within ± 25 microamperes (95 percent probability) of the indicated course. The performance should be free of sustained oscillations.

(4) Glide Slope Performance -

- (a) For the purposes of the demonstration, the airplane should be stabilized on the glide slope before an altitude of 700 feet above the field level is reached.
- (b) From 700 feet altitude to the decision altitude the autopilot/coupler should cause the airplane to track the center of the indicated glide slope to within ± 35 microamperes or ± 12 feet, whichever is the larger, without sustained oscillations.

NOTE: The criteria applicable to manual approaches should be applied when approving autopilots with force wheel steering.

- d. Flight Director Systems. When Category II operations are predicated on two independent flight directors the installation should provide for the following performance under the test condition stated:

- (1) Airplane Speed - Maximum and minimum design approach speeds.
- (2) Wind Conditions (the effects may be shown analytically) - Surface crosswind component of 15 knots. Surface downward component of 10 knots. Wind shear of 4 knots per 100 feet altitude applied along the runway or across the runway individually, commencing at an altitude of 500 feet.

(3) Mode Selection and Indication -

- (a) Manual selection should be positive, and the selection should be clearly identified.
- (b) When the mode of operation is not shown by the manual mode selector and by the command display behavior, means should be employed to clearly annunciate the existing mode.

(4) Localizer Performance -

- (a) The airplane should be stabilized on the localizer for the purpose of demonstration before the outer marker is intercepted on a normal inbound approach.
- (b) From the outer marker to an altitude of 300 feet above runway elevation on the approach path, the flight director should cause the airplane to track within ± 35 microamperes (95 percent probability) of the indicated localizer course. The performance should be free of sustained oscillations.
- (c) From an altitude 300 feet above runway elevation on the approach path to the decision altitude (100 feet), the flight director should cause the airplane to track to within ± 25 microamperes (95 percent probability) of the indicated course. The performance should be free of sustained oscillations.

(5) Glide Slope Performance -

- (a) For the purpose of the demonstration, the airplane should be stabilized on the glide slope before an altitude of 700 feet above the field level is reached.
- * (b) From 700 feet altitude to the decision altitude (100 feet), the flight director should cause the airplane to track the center of the indicated glide slope to within ± 35 microamperes or ± 12 feet, whichever is the larger, without sustained oscillations.*

e. Automatic Throttle System.

- (1) An automatic throttle system, if used, should provide safe operation under conditions which can reasonably be expected in normal service, including wind shear, gusts and sideslips. The system should:

- (a) Automatically adjust throttles to maintain airplane speed to within ± 5 knots of stabilized programmed airspeed, but not less than computed threshold airspeed under all intended flight conditions. Proper operating points such as reference speed or angle-of-attack may be set manually or automatically.
 - (b) Provide throttle application at a rate consistent with the recommendations of the appropriate engine and airframe manufacturers.
 - (c) Maintain stable short period and phugoid airplane modes for all intended flight situations during manual and automatic flight control.
- (2) Malfunction of any part of the system should not restrict either pilot from maintaining safe control of the airplane or engines.
- (a) Disconnect switch(es) readily accessible to both pilot and copilot should be provided.
 - (b) The throttle drive mechanism should be designed to permit manual overriding without application of excessive throttle forces.
 - (c) The maximum servo velocity attainable should be positively limited by design to that required for adequate performance.
 - (d) Appropriate indication of system engagement and disengagement should be provided.
- f. Radio Altimeter. The radio altimeter system should provide the following performance under the test conditions stated:
- (1) Display to the flight crew clearly and positively the altitude information in flight which indicates the airplane main landing gear wheel height above terrain. With respect to the "basic tee," the barometric altimeter may be positioned to the flight and adjacent to the radio altimeter.
 - (2) Under the measurement conditions described, the flight crew presentation should:

- (a) Display altitude to an accuracy of ± 5 feet or ± 5 percent of altitude, whichever is greater, under the following conditions:
 - 1 Pitch angle zero $\pm 5^\circ$ about the mean approach attitude.
 - 2 Roll angle zero to $\pm 20^\circ$.
 - 3 Forward velocity from minimum approach speed up to 200 knots.
 - 4 At altitudes from 100 to 200 feet with sink rates of zero to 15 feet/second.
 - (b) Over level ground the altimeter should track the actual altitude of the airplane without significant lag or oscillation.
 - (c) With the airplane at an altitude of 200 feet or less, any abrupt change in terrain representing no more than 10 percent of the airplane's altitude should not cause the altimeter to unlock, and indicator response to such changes should not exceed 0.1 seconds. If the system unlocks, it should reacquire the signal in less than one second.
 - (d) Systems which contain a push-to-test feature should test the entire system (with or without antenna) at a simulated altitude of less than 500 feet.
 - (e) Failure Warning - The system should provide to the flight crew a positive failure warning display any time there is a loss of power or absence of ground return signal within the specified range of operating altitudes.
- g. Aircraft Configuration Change. The aircraft should be stabilized on the approach at glide slope intercept in the landing configuration with no late stage configuration changes permitted. If the applicant elects to use a flap setting lesser than landing flap, suitable landing performance information must be provided.

APPENDIX 2. GROUND SYSTEM AND OBSTRUCTION CLEARANCE CRITERIA FOR
CATEGORY II OPERATIONS

1. PURPOSE. This Appendix outlines ground system and obstruction clearance criteria for Category II ILS operations. Other FAA Selection Orders, Notices, and Advisory Circulars define system performance and equipment characteristics and are available at any Airport District Office or by writing to the address on the title page of this Advisory Circular.
2. GENERAL. A Category II ILS approach system consists of both electronic and visual guidance systems. The electronic system must be capable of guiding an aircraft to the ILS reference datum with a high degree of accuracy. The visual guidance system must provide the correct visual cues to the pilot from the decision height down to and including the touchdown, and along the runway for rollout, under the appropriate RVR conditions. Airports which do not meet the criteria established in this Appendix, but where an operational or other evaluation identifies that an equivalent level of safety exists, may be authorized appropriate ILS Category II minimums. Such an evaluation shall be conducted by Flight Standards or other Service as appropriate.

Foreign airports served by United States carriers or commercial operators may be approved in accordance with the provisions of ICAO Annex 3 on a basis of a comparable level of safety.

3. SECTION I - CATEGORY II GROUND SYSTEM

- a. Electronic Guidance System. An instrument landing system which meets Category II performance standards and provides continuous electronic guidance to the ILS reference datum and consists of the elements described below:
 - (1) Localizer. The localizer provides azimuth guidance from the specified coverage limit down to the ILS reference datum as indicated in the U.S. Flight Inspection Manual.
 - (2) Glide Slope. The glide slope provides guidance in the vertical plane from the specified coverage limit down to the ILS reference datum as indicated in the U.S. Flight Inspection Manual.
 - (3) VHF Marker Beacons. In addition to the outer and middle marker beacons, a 75 mc inner marker beacon is provided at each Category II ILS installation as a system requirement and is one method of identifying the decision height.

- b. Visual Guidance System. The Category II lighting system provides continuous visual guidance from the point where transition from Category II instrument flight to visual reference is initiated. The visual system provides guidance for the approach, flare, landing, and rollout. The system will consist of the following components:
- (1) Approach Lighting System. Pending retrofit to Category II lighting standards outlined in Selection Order 1010.39, ILS Category II operations will be authorized on the present Category I, Configuration "A", 3000-foot approach lighting system (ALS). When retrofitted, these and all subsequent Category II ALS will conform to Selection Order 1010.39 except that no negative gradient will be permitted in the inner 1500 feet. Where required, and when fixtures are available, approved flush approach lighting system may be installed, i.e., displaced landing threshold.
 - (2) Touchdown Zone Lighting System. A touchdown zone lighting system will be provided for each Category II ILS runway defining the runway touchdown zone and conforming to AC 150/5340-4B.
 - (3) Centerline Lighting System. A centerline lighting system will be provided for each Category II ILS runway defining the runway centerline and conforming to AC 150/5340-4B. Existing L-842 300 candlepower centerline lights on 25-foot spacing may be approved for 1600 RVR day, and 1200 RVR night. 1200 RVR day and night may be approved for existing L-843 and L-850 runway centerline lighting systems.
 - (4) High Intensity Runway Edge Lighting. A high intensity runway edge lighting system will be provided for each Category II ILS runway defining the lateral and longitudinal limits of the runway and conforming to AC 150/5340-13A. The operating limit of existing L-818, L-819, or L-820 runway edge light systems will be determined by the FAA on an individual basis.
 - (5) Taxiway Turnoff Lighting Systems. Taxiway turnoff lighting systems are not required for Category II operations. The FAA policy on these systems is contained in FAA Selection Order 1010.40.
 - (6) All-Weather Runway Markings. Category II runways will be marked with all-weather runway markings as specified in AC 150/5340-1C.

- c. Other Requirements. The following additional systems are required as part of the Category II ILS system.

(1) Runway Visual Range (RVR).

- (a) For operations below 1600 RVR, two transmissometers are required to provide visibility information at the approach and rollout ends of the Category II runway. Where an initial transmissometer installation is being made on a Category II runway, both transmissometers will be installed on a 250-foot baseline. Where a Category I runway is updated to Category II status, the touchdown zone transmissometer may be on a 500 or 250-foot baseline. On the rollout end of the Category II runway, the transmissometer will be installed on a 250-foot baseline.
- (b) Transmissometers serving other runways may be used to provide the RVR information in the rollout area of the Category II runway. Where transmissometers from other runways are used for this purpose, the transmissometer will be located within a radius of 2000 feet of the rollout threshold of the Category II runway and will provide a minimum of 2000 feet coverage of the Category II rollout area as measured from the rollout threshold of the Category II runway.
- (c) FAA Standard 008 prescribes installation criteria for RVR equipment.

(2) Radar (Radio) Altimeter Setting Height. Radar (radio) altimeter setting heights will be provided on the FAA Form 8260-7, indicating the vertical distance at the 100/150-foot decision heights between the glide slope and the terrain beneath these points, on the runway centerline extended.

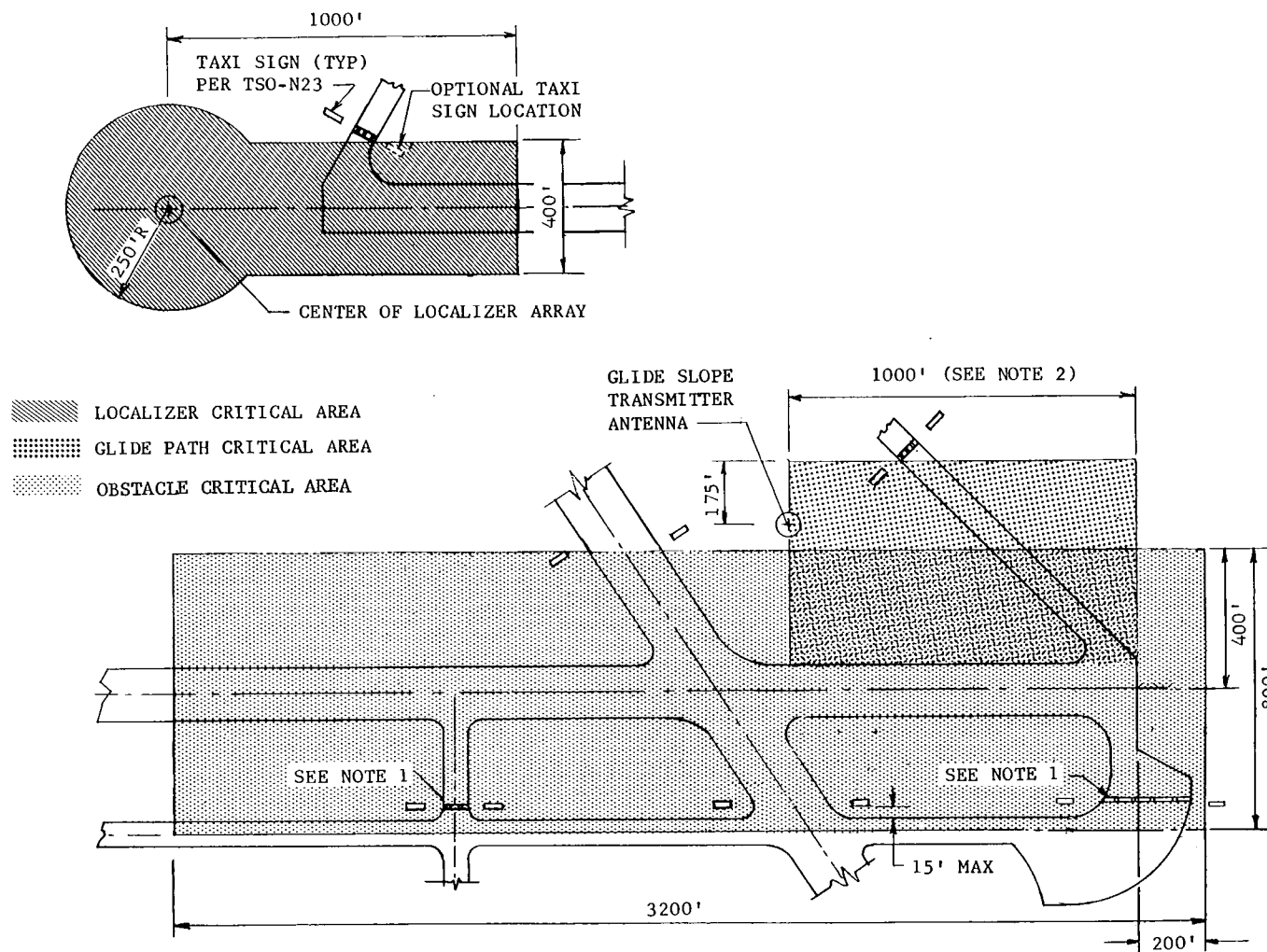
(3) Remote Monitoring. Remote monitoring shall be provided for the following elements of the Category II ILS system:

- (a) Glide slope, localizer, and marker beacons.
- (b) Approach lighting system.

(4) Manual Inspection. The following systems are not remotely monitored and will require frequent inspection by airport management or FAA personnel or frequent pilot reports to determine if they are operated and maintained in accordance with the criteria.

- (a) Touchdown zone and centerline lights.
- (b) Runway edge lights.
- (c) Runway markings.

- d. Critical Areas. Category II ILS glide slope, localizer, and obstacle critical areas will be marked and lighted to insure that ground traffic does not violate these areas during Category II operations. These areas are shown in Figure I and defined as follows:
- (1) Glide Path Critical Area. The glide path critical area is a rectangular area extending from the glide slope transmitting antenna to:
 - (a) 1000 feet in the direction of the approach end of the runway, or to the end of the runway, whichever is greater.
 - (b) "0" feet in the opposite direction.
 - (c) To the near edge of the runway which the ILS serves.
 - (d) 175 feet in the direction away from the runway.
 - (2) Localizer Critical Area. The localizer critical area is a rectangular area extending from the localizer transmitting antenna 1000 feet in the direction of the approach end of the runway and 200 feet on either side of the runway centerline. An additional area is described as a circular area with a radius of 250 feet from the center of the localizer and connecting to the parallel lines on either side of the runway.
 - (3) Obstacle Critical Area. The obstacle critical area is a rectangular area longitudinally centered on the runway centerline, extending from a point 200 feet outward from the Category II landing threshold (normal or displaced) and extending 3200 feet in the direction of landing and having a total width of 800 feet.
 - (4) Aircraft on Ground. Procedures should be established to prevent taxiing aircraft awaiting departure from approaching closer than 400 feet to the runway centerline while a Category II ILS landing is being made. The distance shall be measured to the nearest point on the longitudinal axis of the aircraft with the aircraft positioned either parallel to or facing the runway.
4. OBSTACLE CLEARANCE CRITERIA. This section prescribes the obstacle clearance criteria for the final and missed approach areas for use in the formulation of ILS Category II procedures.



NOTE 1. Location of hold lines when operations are permitted on a 400' parallel taxiway.
2. Or to the end of the runway, whichever is greater.

FIGURE 1. CATEGORY II CRITICAL AREAS

- a. Final Approach. The final approach begins at the Final Approach Fix (FAF) and ends at the runway or missed approach point (DH). The FAF in ILS procedures is the point where the glide slope is intercepted and descent to the authorized decision height has begun. The FAF may be identified by an outer marker, compass locator, DME, radar, or other fix.
- b. Final Approach Area. The final approach area has the following dimensions:
- (1) Length. The basic final approach area is 50,000 feet long, measured outward along the final approach course from a point 200 feet outward from the runway threshold. The final approach area used in a procedure shall be that portion of the basic area which is between the FAF and the 200-foot point outward from the runway threshold.
 - (2) Width. The final approach is centered on the extended runway centerline. It has a total width of 1,000 feet at the inner end and expands uniformly to a total width of 16,000 feet at the outer end which is 50,000 feet from the point of beginning.
- c. Final Approach Surface. The final approach surface is an inclined plane which originates at the runway threshold elevation, 200 feet outward from the threshold, and which overlies the final approach area. The surface is divided into two sections; an inner 10,000-foot section and an outer 40,000-foot section. The slope of the surface changes at the 10,000-foot point. The exact gradient may differ according to the angle at which the glide slope is established. The 50:1 and 40:1 slopes which are applicable to the 2-1/2 degree glide slope shall be established unless other slopes must be used to assure required clearance over existing obstructions. The table below specifies slopes which provide minimum required obstruction clearance for several glide slope angles.

<u>GS Angle</u>	<u>Slope of Inner Section</u>	<u>Slope of Outer Section</u>
2 degrees	94:1	60:1
2-1/4 degrees	65:1	48:1
2-1/2 degrees	50:1	40:1
2-3/4 degrees	40:1	34:1
3 degrees	34:1	29.5:1

- d. Final Approach Area Transitional Surfaces. Transitional surfaces are inclined planes with slopes of 7:1, which extend outward and upward from the edge of the final approach area, starting at the height of the approach surface and extending for a lateral distance of 5,000 feet at right angles to the runway centerline.

- e. Obstruction Clearance. No obstruction shall penetrate the applicable final approach surface specified in paragraph 4.c. When obstructions penetrate the final approach area transitional surfaces, and when deemed necessary, consideration will be given to an adjustment in the Decision Height (DH) commensurate with the degree of interference presented by the particular obstruction or obstructions.
5. SPECIAL OBSTRUCTION CLEARANCE AREAS. Because of the lower flight altitudes which occur in the immediate vicinity of the runway during ILS Category II approach and missed approach, it is necessary to specify certain areas in which obstructions must be eliminated or controlled. These special areas are the Approach Light Area, the Touchdown Area, the Transitional Surfaces, and the Missed Approach Area.
6. APPROACH LIGHT AREA. (See Figure 2)
 - a. Definition. An area longitudinally centered on the extended centerline of the ILS Category II runway, and extending outward from the end of the Touchdown Area (See Paragraph 7) to a point 200 feet beyond the last approach light fixture, and having a total width of 400 feet.
 - b. Obstruction Clearance. No obstruction shall penetrate the approach light plane. Further, no obstruction, including the approach light structure or fixtures, shall penetrate a 50:1 surface which originates at the same point as the final approach area (See Paragraph 4.b(1) at the elevation of the runway threshold. The 50:1 surface over the Approach Light Area remains a constant requirement even when other portions of the final approach surface are adjusted for glide slope angles greater than 2-1/2 degrees. However, where glide slope angles of less than 2-1/2 degrees are established, no obstruction in the Approach Light Area shall penetrate the associated approach surface.

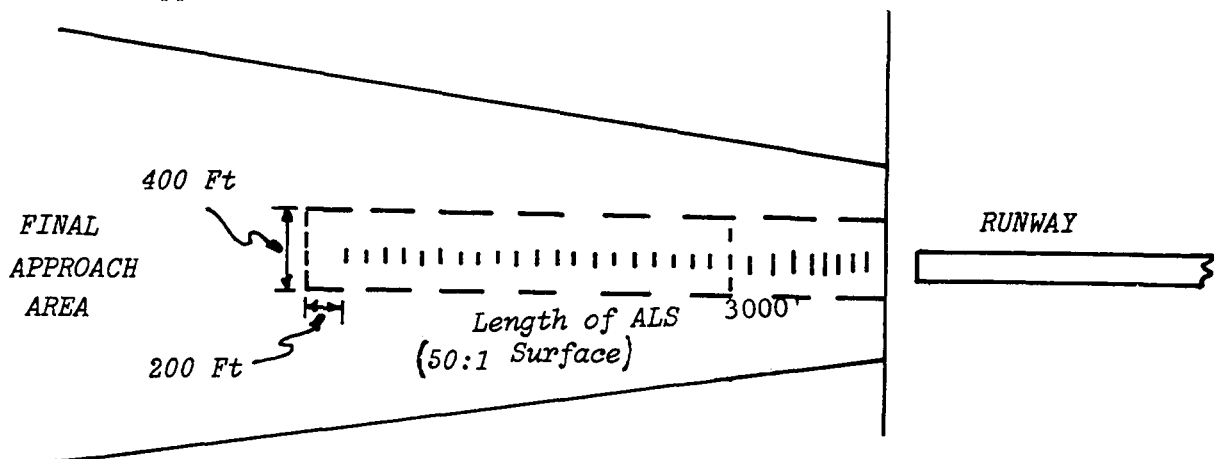


FIGURE 2. Approach Light Area

7. TOUCHDOWN AREA. See Figure 3.

- a. Definition. An area longitudinally centered on the runway centerline, extending from a point 200 feet outward from the runway threshold (normal or displaced) for a distance of 3200 feet in the direction of landing, and having a total width of 1000 feet.
- b. Obstruction Clearance. The only obstructions permitted in the Touchdown Area are those objects which are fixed by their functional purpose or which are required for precision approaches to the Category II ILS runways. All objects except visual aids and frangible functional objects shall be appropriately marked and lighted unless shielded by a properly lighted and marked functional object. The identity and height limits of acceptable objects are as follows:
 - (1) Visual Aids. Unless flush-mounted, all visual aids shall be installed on frangible mounts. Maximum height is 14 inches above the surface where the fixture is located. Except that taxiway guidance signs may be installed in accordance with Advisory Circular 150/5340-18.
 - (2) Glide Slope Antenna. The mast or monitor mast shall be no closer than 400 feet to the ILS Category II runway centerline, and should not exceed 55 feet in height above the elevation of the runway centerline nearest it. A mast of over 55 feet may be permitted if the minimum distance from the runway centerline is increased by 10 feet for each foot the mast exceeds 55 feet in height.
 - (3) Structures. Those structures which are elements of the Glide Slope, PAR, or RVR systems (except GS antenna or monitor masts) should not exceed 15 feet in height above the elevation of the runway centerline nearest them, and in addition may be no closer to the runway centerline than 400 feet. When such structures are more than 15 feet high, they may be permitted if the minimum distance from the runway centerline is increased 10 feet for each foot the structure exceeds 15 feet. Frangible PAR reflectors are not considered to be obstructions.

8. TOUCHDOWN AREA TRANSITIONAL SURFACES (See Figure 3)

- a. Definition. Transitional Surfaces sloped at 7:1 extend outward and upward from the edges of the Touchdown Area and Section 1 of the Missed Approach Area (See Paragraph 9) to a height of 150 feet above the elevation of the runway centerline at the end of the touchdown area.

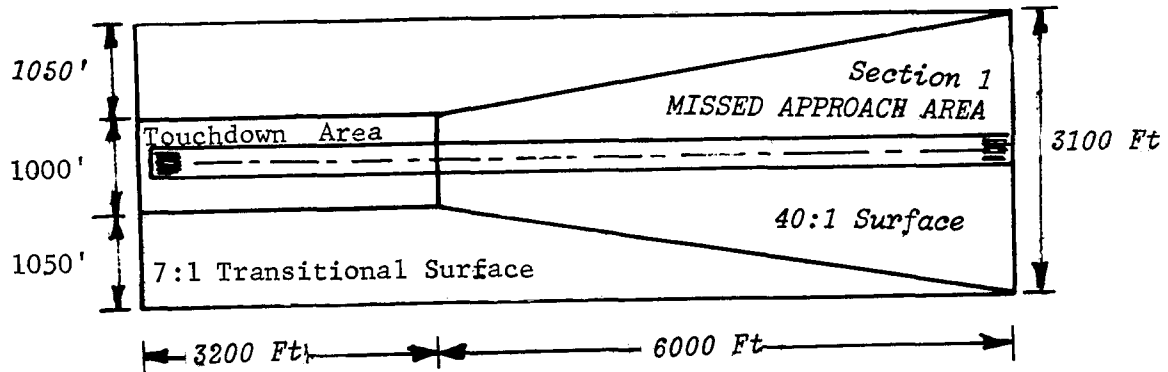


FIGURE 3. OBSTRUCTION CLEARANCE AREAS: ILS Category II.

- b. Obstruction Clearance. When an obstruction penetrates the 7:1 transitional surfaces and when deemed necessary, adjustment in the RVR minimum will be made commensurate with the degree of interference presented by the obstruction. Such adjustment will be approved by Flight Standards Service. A caution note will be added to the approach procedure to identify obstacles which penetrate the 7:1 surfaces.
9. MISSED APPROACH AREA. A missed approach will be specified to commence at the DH if the required visual reference has not been established. However, it is possible that aircraft will continue to descend through the decision height while initiating the missed approach, or that a decision to land may be altered by circumstances and the approach aborted at a lower altitude. In either case the missed approach obstruction clearance criteria must consider aircraft which have progressed into the touchdown area to heights below the decision height, perhaps even to a momentary touchdown. There are two Sections to the Missed Approach Area, and a special treatment for the turning missed approach is also necessary.
- a. Missed Approach Section 1. This portion of the area begins at the end of the Touchdown Area at the height of the runway, and is longitudinally centered on the runway centerline. It has the same width as the touchdown area at the point of beginning (1,000 feet) and the width increases uniformly to 3,100 feet at 6,000 feet from the point of beginning. (See Figure 3)

- b. Missed Approach Section 2. This portion of the area starts at the end of Missed Approach Section 1 and is centered on a continuation of the Section 1 course. The width increases uniformly from 3100 feet at the beginning to 8 miles at a point 15 miles from the runway threshold. When positive course guidance is NOT provided for the missed approach procedure, secondary areas which are zero miles wide at the point of beginning and increase uniformly to 2 miles wide at the end of Missed Approach Section 2, must be added to the edges of Section 2. (See Figure 4)
- c. Turning Missed Approach Area. (Applies to turns of over 15 degrees). The design of the turning missed approach area assumes that aircraft missing an approach will climb straight ahead until reaching a height of at least 300 feet above the elevation of the runway centerline at the end of the Touchdown Area. The procedure will identify the obstruction if a turn toward a significant obstruction has to be made. The turning flight track radius shall be 1.75 miles, and it shall be plotted to begin at the end of Missed Approach Section 1. The outer boundary of Missed Approach Section 2 shall be drawn with a 3.5 mile radius. The inner boundary line shall commence at the outer edge of the transitional surface opposite the end of the Touchdown Area. The outer and inner boundary line shall terminate at points 4 miles each side of the assumed flight track 15 miles from the runway threshold. (See Figures 5 and 6). Where secondary areas are required, they shall commence after completion of the turn. Turns in the missed approach area are normally specified to commence after reaching a height of 300 feet. Where an operational requirement exists to continue the climb of the aircraft to a height of more than 300 feet prior to commencing a turn, Missed Approach Section 1 will continue to increase uniformly in width, and will be extended longitudinally 4000 feet for each 100 feet of height over 300 feet. In addition, the 7:1 Transitional Surface (Paragraph 8.a.) is also extended laterally on the inside of the turn to a height equal to the elevation attained by the extension of Missed Approach Section 1.

NOTE: Where a positive course guidance is provided in Section 2 consideration may be given to reducing the width of this Section.

d. Obstruction Clearance.

- (1) Straight Missed Approach. No obstruction in Sections 1 or 2 may penetrate a 40:1 surface. This surface originates at the beginning of Section 1 at the elevation of the runway centerline at the end of the touchdown area, and overlies the entire Missed Approach Area.

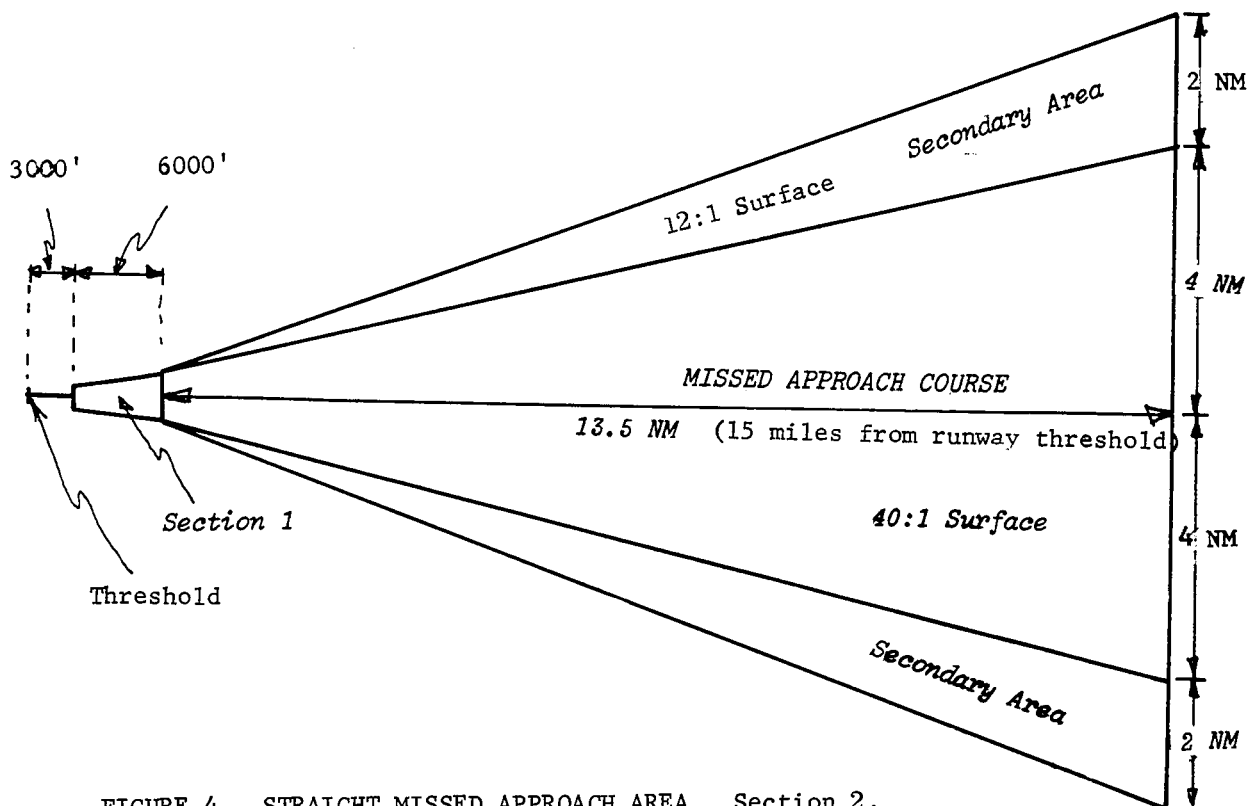


FIGURE 4. STRAIGHT MISSED APPROACH AREA. Section 2.

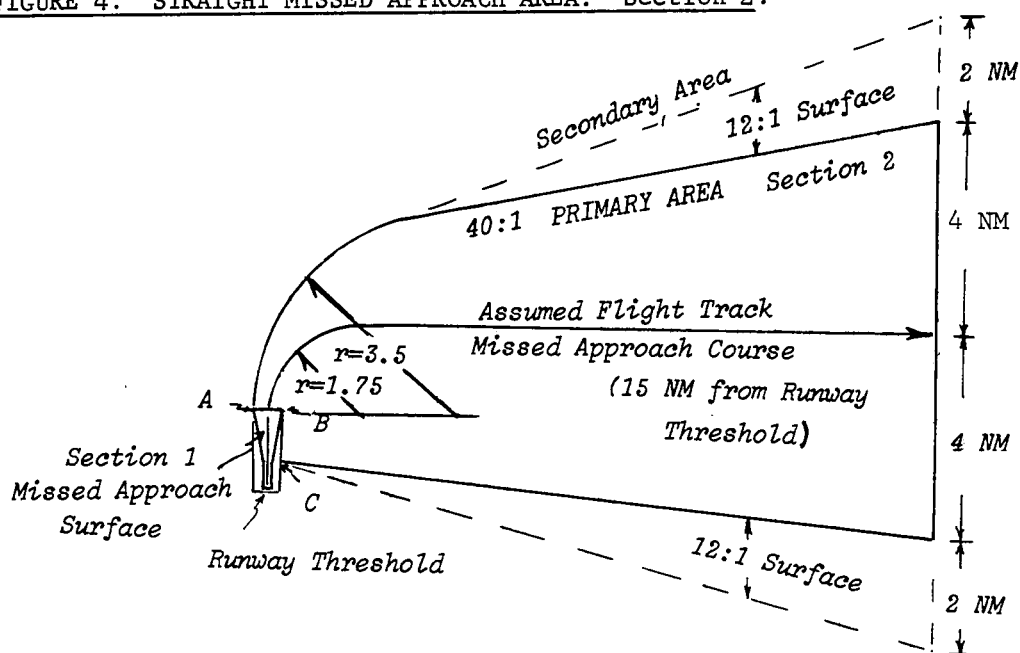


FIGURE 5. TURNING MISSED APPROACH AREA Section 2

(2) Turning Missed Approach. Section 1 obstruction clearance is the same as that for straight missed approach. To determine the obstruction clearance requirements in Section 2, the lines A-B and B-C are identified in Figures 5 and 6. The height of the missed approach surface over any obstruction in Section 2 is determined by measuring the distance from the obstruction to the nearest point on the line A-B or B-C and computing the height according to the 40:1 ratio starting at the elevation of line A-B or B-C. Note that lines A-B and B-C are always at the same elevation as the end of Section 1. (See Figure 6).

(3) Secondary Areas. Where secondary areas are considered, no obstruction may penetrate a 12:1 surface which slopes outward and upward from the missed approach surface.

* 10. GLIDE SLOPE ANGLE. The maximum angle is 3.0 degrees. An angle less than 2.5 degrees will be established only to satisfy a unique operational requirement, and must be justified by special study for consideration of approval by Flight Standards Service, Washington, D.C. *

11. GLIDE SLOPE THRESHOLD CROSSING HEIGHT. The optimum glide slope threshold crossing height is 50 feet. The maximum is 60 feet. A height as low as 47 feet may be used at locations where special consideration of the glide path angle and antenna location are required. Heights are measured at the landing threshold. See TERPs' Appendix 1, paragraph 10, for method of computing this height.

*NOTE: Use of glide slope crossing heights as low as 47 feet are predicated on the vertical distance between the aircraft glide slope antenna and the lowest part of the main landing gear wheels not exceeding 19 feet with the aircraft in its normal landing approach attitude. *

12. ADJUSTMENT TO CATEGORY II ILS MINIMUMS. The decision height is measured from the highest elevation of the runway in the touchdown area. The lowest minimums permitted by the Category II system are a decision height of 100 feet and RVR 1200. Application of Category II obstruction clearance criteria may identify objects which exceed the allowable height in the touchdown area or penetrate the approach light surface. In such cases, adjustment to the decision height shall be made as follows:

Final Approach Surface - Requires a special study of local features and conditions before Category II operation can be authorized by Flight Standards Service, FAA, Washington, D.C.

Approach Light Surface - Adjust the DH upward one foot for each one foot an object exceeds the allowable height.
and
Touchdown Area The RVR value will then be adjusted as indicated in the table:

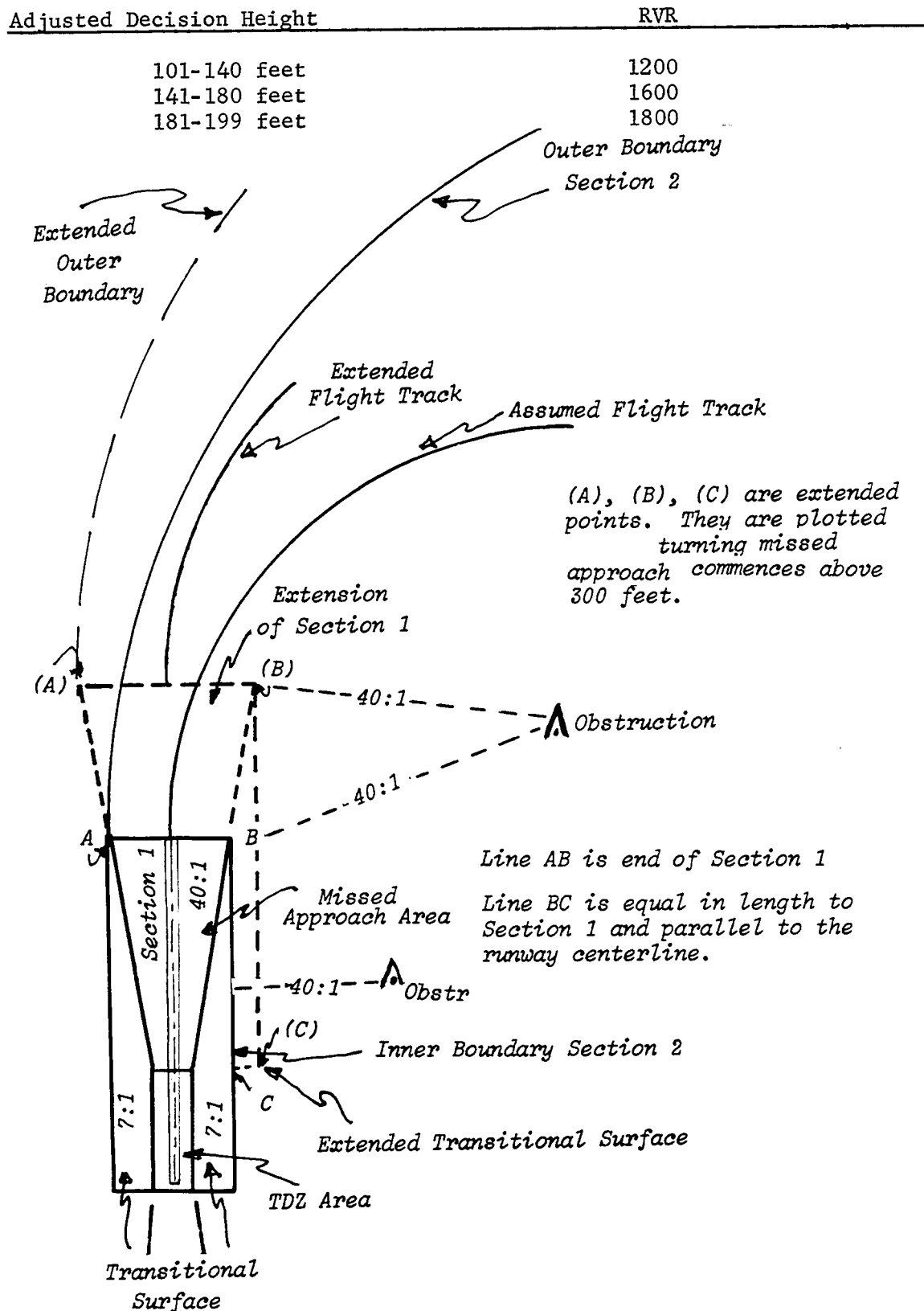


FIGURE 6. TURNING MISSED APPROACH AREA CONSTRUCTION DETAIL. ILS Category II.

13. OBSTRUCTIONS IN THE MISSED APPROACH AREA. The 40:1 missed approach surface is established to identify objects which may be a hazard in the missed approach area. Objects which do not penetrate the 40:1 surface are not considered a hazard. When an object penetrates the 40:1 surface the missed approach procedure will contain a caution note which specifies a rate of climb in feet per minute which is required to clear the controlling obstruction by 50 feet. For example: An obstruction is 30,000 feet from the point where the missed approach surface starts and 900 feet above this point. A climb gradient of approximately 190 feet per mile is required to clear this 900-foot obstruction by 50 feet. Expressed in feet-per-minute for a range of ground speeds this becomes:

100K - 315	Feet Per Minute
150K - 470	" " "
200K - 630	" " "

The caution note should read as follows: "Obstructions in the missed approach area require a rate of climb of at least 315 fpm/100K, 470 fpm/150K, 630 fpm/200K, no wind conditions."

